WHAT WE CLAIM ARE:

1. Silicon oxycarbide which contains hydrogen and has a carbon content of at least about 18 at% and a specific dielectric constant of at most about 3.1.

2. The silicon oxycarbide according to claim 1, wherein said carbon content is at most about 25 at%.

3. The silicon oxycarbide according to claim 1, wherein tetramethylcyclotetrasiloxane is used as source gas.

4. Silicon oxycarbide whose hydrogen content is at most 30 at% and whose specific dielectric constant is at most about 3.1.

5. The silicon oxycarbide according to claim 4, wherein the hydrogen content is at most 28 at%.

6. A method of growing a silicon oxycarbide layer comprising the steps of:

preparing an underlying layer; and

growing a silicon oxycarbide layer on said underlying layer by vapor deposition using, as source gas, tetramethylcyclotetrasiloxane, carbon dioxide gas and oxygen gas, a flow rate of said oxygen gas being at most 3 % of a flow rate of said carbon dioxide gas.

7. The method of growing a silicon oxycarbide layer according to claim 6, wherein the flow rate of said oxygen gas is 0 %.

8. The method of growing a silicon oxycarbide layer according to claim 6, wherein said vapor deposition is performed at a pressure lower than 4 torr.

9. The method of growing a silicon oxycarbide layer according to claim 8, further comprising the step of performing a CO_2 plasma process after the growth of said silicon oxycarbide layer.

10. The method of growing a silicon oxycarbide layer according to claim 6, wherein said vapor deposition is performed at a pressure higher than 4 torr.

11. The method of growing a silicon oxycarbide layer according to claim 6, wherein said vapor deposition is a plasma enhanced vapor deposition.

12. A semiconductor device comprising:

a semiconductor substrate;

a copper wiring formed above said semiconductor substrate;

a silicon carbide layer covering said copper wiring; and

a first silicon oxycarbide layer covering said silicon carbide layer, said first silicon oxycarbide layer containing hydrogen and having a carbon content of at least about 18 at% and a specific dielectric constant of at most about 3.1.

13. The semiconductor device according to claim 12, wherein said carbon content of said first silicon oxycarbide layer is at most 25 at%.

14. The semiconductor device according to claim 12, further comprising a second silicon oxycarbide layer formed on said first silicon oxycarbide layer, said second silicon oxycarbide layer having the carbon content at least 1 at% smaller than the carbon content of said first silicon oxycarbide layer.

15. The semiconductor device according to claim 12, further comprising a low dielectric constant insulating layer formed on said first silicon oxycarbide layer, said low dielectric constant insulating layer having a specific dielectric constant lower than a specific dielectric constant of silicon oxide.

16. A semiconductor device comprising:

a semiconductor substrate;

a copper wiring formed above said semiconductor substrate;

a silicon carbide layer covering said copper wiring; and

a first silicon oxycarbide layer covering said silicon carbide layer, said first silicon oxycarbide layer containing hydrogen and having a hydrogen content of at most 30 at% and a specific dielectric constant of at most about 3.1.

17. The semiconductor device according to claim 16, wherein said hydrogen content is at most 28 at%.

18. The semiconductor device according to claim 16, further comprising a second silicon oxycarbide layer formed on said first silicon oxycarbide layer, said second silicon oxycarbide layer having the hydrogen content at least 2 at% larger

than the hydrogen content of said first silicon oxycarbide layer.

19. The semiconductor device according to claim 16, further comprising a low dielectric constant insulating layer formed on said first silicon oxycarbide layer, said low dielectric constant insulating layer having a specific dielectric constant lower than a specific dielectric constant of silicon oxide.

20. A semiconductor device comprising:

a semiconductor substrate;

a copper wiring formed above said semiconductor substrate;

a silicon carbide layer covering said copper wiring; and

a first silicon oxycarbide layer covering said silicon carbide layer, said first silicon oxycarbide layer containing hydrogen and having a carbon content of at least 17 at% or a hydrogen content of at most 30 at% and a specific dielectric constant of at most about 3.1.

21. The semiconductor device according to claim 20, further comprising a second silicon oxycarbide layer formed on said first silicon oxycarbide layer, said second silicon oxycarbide layer having the carbon content at least 2 at% lower than the carbon content of said first silicon oxycarbide layer or the hydrogen content at least 2 at% larger than the hydrogen content of said first silicon oxycarbide layer.

22. The semiconductor device according to claim 20, further comprising a low dielectric constant insulating layer formed on said first silicon oxycarbide layer,

said low dielectric constant insulating layer having a specific dielectric constant lower than a specific dielectric constant of silicon oxide.

23. A method of manufacturing a semiconductor device comprising the steps of:

preparing an underlying structure having a semiconductor substrate, a copper wiring formed above said semiconductor substrate and a silicon carbide layer covering said copper wiring; and

growing a silicon oxycarbide layer on said underlying structure by vapor deposition using, as source gas, tetramethylcyclotetrasiloxane, carbon dioxide gas and oxygen gas, a flow rate of said oxygen gas being at most 3 % of a flow rate of said carbon dioxide gas.

24. The method of manufacturing a semiconductor device according to claim 23, wherein the flow rate of said oxygen gas is 0 %.

25. The method of manufacturing a semiconductor device according to claim 23, wherein following the growth of said silicon oxycarbide layer, a surface of said silicon oxycarbide layer is slightly oxidized with CO_2 plasma.

26. The method of manufacturing a semiconductor device according to claim 23, further comprising the step of forming a trench in an insulating layer including said silicon oxycarbide layer and burying a wiring in said trench.

27. A method of manufacturing a semiconductor device comprising the steps of:

preparing an underlying structure having a semiconductor substrate,

a copper wiring formed above said semiconductor substrate and a silicon carbide layer covering said copper wiring;

making hydrophilic a surface of the silicon carbide layer of said underlying structure by using plasma of oxidizing gas which contains oxygen and has a molecular weight larger than a molecular wright of O_2; and

forming a low dielectric constant insulating layer on the surface of said hydrophilic silicon carbide layer, said low dielectric constant insulating layer having a specific dielectric constant lower than a specific dielectric constant of silicon oxide.

28. The method of manufacturing a semiconductor device according to claim 27, wherein said step of making hydrophilic by using the plasma is a step of exposing said underlying structure to down-flow of plasma.

29. The method of manufacturing a semiconductor device according to claim 27, wherein said step of making hydrophilic by using the plasma is performed in a same chamber as used by said step of forming said low dielectric constant layer.

30. The method of manufacturing a semiconductor device according to claim 27, wherein said weak oxidizing gas is CO_2.